RF/RMRS-99-304

Final
Field Implementation Plan For The East Trenches Plume Treatment System

Revision 0

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Rocky Mountain Remediation Services, L.L.C.

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January 1999

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ACRONYMS

ALF	Action Level Framework
ASTM	American Society of Testing and Materials
bgs	Below ground surface
CQA	Construction quality assurance
CQC	Construction quality control
CTR	Contractor Technical Representative
DOE	Department of Energy
DOT	Department of Transportation
EM-40	DOE Environmental Restoration Program
EM-50	DOE Office of Science and Technology
EPA	U S Environmental Protection Agency
ES&H	Environmental Safety and Health
ETP	East Trenches Plume
ETPTS	East Trenches Plume Treatment System
FIP	Field Implementation Plan
gpm	Gallons per minute
HASP	Health and Safety Plan
HSO	Health and Safety Officer
MSGP	Mound Site Groundwater Plume
MSPTS	Mound Site Plume Treatment System
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
OHM	OHM Energy Services
PAM	Proposed Action Memorandum
PPE	Personal protective equipment
PSS	Plant Shift Supervisor
QA	Quality assurance
RCRA	Resource Conservation and Recovery Act
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services, L L C
VOCs	Volatile organic compounds

1. INTRODUCTION

This Field Implementation Plan (FIP) will describe in detail the tasks and procedures required for the installation of the subsurface groundwater collection and treatment system for the East Trenches Plume (ETP) The East Trenches Plume Treatment System (ETPTS) is intended to collect and treat the contaminated groundwater, which is above the Action Level Framework Tier II level concentrations defined in Attachment 5 of the Rocky Flats Cleanup Agreement (RFCA) The ETP remediation is authorized as an accelerated action under the East Trenches Plume Proposed Action Memorandum (PAM)

The ETPTS will employ an innovative technology for the remediation of a contaminated groundwater plume at the Rocky Flats Environmental Technology Site (RFETS) The ETPTS will utilize the reactive iron technology recently implemented at the Mound Site Plume The Mound Site Plume was a remediation demonstration which was executed as a cooperative effort between the Department of Energy (DOE) Environmental Restoration Program (EM-40), and the DOE Office of Science and Technology (EM-50), with support from the National Risk Management Research Laboratory of the U S Environmental Protection Agency (EPA)

The ETPTS will involve an in-ground barrier system with in situ water treatment, and will consist of treatment cells, an impermeable barrier membrane, an engineered porous and permeable media, groundwater collection piping, and barrier monitoring system The lessons learned during the installation of the Mound Site Plume have been incorporated into the construction strategy for the ETPTS

In accordance with the PAM, the overall objectives of the ETPTS are

- Intercept and treat VOC-contaminated groundwater at the distal end of the ETP consistent with RFCA
- To the extent practicable, protect surface water and reduce the VOC-contaminant mass loading in surface water
- Installation of an easily accessible system to reduce operation and maintenance costs, and for ease in media replacement or final removal
- Minimize the impacts to the Prebles Meadow Jumping Mouse during construction by installing silt fences between the construction area and South Walnut Creek to prevent downstream sedimentation of habitat
- Avoid depletion of waters to South Walnut Creek

1 1 Site History

The ETP is located north of Central Avenue, east of the RFETS Protected Area, and along the northern edge of the B-series Ponds access road The ETP consists of groundwater contaminated with volatile organic compounds (VOCs) derived from the East Trenches Area The East Trenches Area is on the north side of the East Access Road, and was used between 1964 and 1967 for disposal of sanitary sewage sludge contaminated with low levels of uranium and plutonium Crushed drums and miscellaneous wastes were also disposed of in the East Trenches Area A few of trenches were excavated and treated as part of an accelerated source removal action The treated soil below the Tier II action levels was returned to the excavation, and the site was restored Some soil between the Tier I and II levels were wrapped in geotextile and also returned to the excavation

1 2 Site Geology and Hydrology

The ETP Site is located along the southern edge of South Walnut Creek Drainage The surficial deposits consist of up to 18 feet of Rocky Flats Alluvium, colluvium and slump deposits Bedrock, sloping north, underlies the surficial deposits and consists of weathered claystone and minor sandstones associated with the Arapahoe No 1 Sandstone This sandstone is truncated by the South Walnut Creek drainage and subcrops beneath the colluvium

Depth to groundwater is approximately 4 to 14 ft at the ETP Site and flows north to northeast with discharge as seeps, springs, and evaporation in the area near South Walnut Creek The flow rate for the plume is projected at 2 5 feet per day, 2 feet per day of the flow is attributed to the subcropping Arapahoe No 1 Sandstone

1 3 Technology Description and Purpose

The purpose of this project is design, furnish, install, and startup a subsurface groundwater collection system coupled with a passive reactive metals treatment system The ETPTS will be oriented generally in an east-west direction between piezometers 22597 and 23597 The ETPTS will be approximately 1,100 feet in length at a depth of approximately 16 to 26 bgs with an average width at grade of approximately 15 feet The collection system will be installed at least 6 inches and an average of 3 feet into the claystone The treated water will be discharged to groundwater using an infiltration gallery adjacent to South Walnut Creek

The technology addressed in this FIP uses innovative barrier technology as a groundwater control technology to capture, redirect, and treat contaminated groundwater, and disperse the treated groundwater The ETPTS will consist of

- A single-membrane, impermeable 1,100 feet containment barrier, which will be keyed into the underlying bedrock, located approximately 10 to 26 feet bgs The upgradient side of the membrane will be backfilled with a graded filter material
- A four-inch perforated HDPE pipe will be placed in the backfill material and piped to a collection sump The sump will be piped to two treatment cells located downgradient of the barrier and collection system
- Zero valent iron will be used in the treatment cells to remediate the contaminated groundwater to RFCA Action Level Framework Tier II level concentrations
- Installation of three in-trench multiple depth monitoring points on the upgradient side of the barrier
- Installation of four groundwater monitoring wells to aid in the evaluation and monitoring of the performance of the groundwater recovery system
- Abandonment of 11 geoprobe wells in or around the barrier wall

2 0 FIELD EXECUTION

The ETP consists of the installation of a groundwater collection and treatment system for the East Trenches Area Parsons Infrastructure & Technology Group, Inc (Parsons) has prepared a detailed design package including Construction Drawings and Construction Specifications The following sections detail the procedures for installing the ETPTS

The sequence of construction activities is expected to involve the following mobilization of equipment and personnel, ETP Site preparation, discharge and reactor area construction, collection trench construction, well construction and abandonment, collection sump construction, work area restoration, and demobilization of equipment and personnel The work is scheduled to be initiated on January 4, 1999 and completed May 1, 1999

2.1 Mobilization

The project field crew, health and safety materials, vehicles, and small equipment will be jointly mobilized primarily from the OHM Energy Services (OHM) office in Denver, Colorado All heavy equipment, support equipment, and subcontractor services will be obtained from the OHM Denver Yard or vendors in the local area Mobilization of a Project Manager, Health and Safety Officer (HSO), and Superintendent who are experienced with the installation of barrier systems and associated construction techniques will be mobilized as needed to meet project objectives

The project construction work will require the following equipment to be mobilized from the OHM Denver Yard or rented from local vendors Some of the equipment required on-site includes

- One rubber-tired front-end loader with interchangeable fork lift attachment
- One bulldozer
- One backhoe
- Articulating Manlift
- Two boom trucks/cranes
- Office equipment
- Computers
- Two pickup trucks
- Air monitoring equipment
- Miscellaneous equipment

Materials and personal protective equipment (PPE) will be brought to the site by OHM or procured from local vendors and delivered to the site The following documentation and permitting will be approved and available before starting the ETP

Provided by OHM

1 A Field Implementation Plan identifying project goals and requirements is required for the ETPTS
2 Health and Safety Plan A construction health and safety plan (HASP) that has been reviewed and approved by DOE and Rocky Mountain Remediation Services, L L C (RMRS) will be available for review by site workers and visitor personnel prior to the commencement of work and at all times during construction The HASP will be available at the work site location Amendments to the HASP will be incorporated as required The HASP will be required reading for all project personnel
3 Preconstruction environmental safety and health (ES&H) training prior to commencement of work shall be provided for all project contractor site workers and management personnel Each day, construction will begin with a plan-of-the-day and safety meeting, and a record of such training will be maintained in the project logbook
4 Project support subcontracts shall be in place prior to the start of construction and shall include the following

- Construction equipment shall be contracted for and mobilized prior to commencement of construction, or on an as needed basis
- Backfill material and the material shall be available for use at the commencement of construction
- Contract ES&H support will be available during all phases of installation and construction for this project

Provided by Others

1 It is anticipated that installation of the ETPTS at this site can be done under existing agreements between the site owners and the State of Colorado regulatory agencies, and that no additional permits will be required Site specific permits will be required such as a ground disturbance permit Site specific permits will be obtained and coordinated with the CTR
2 The National Environmental Policy Act (NEPA) requires federal agencies to use a systematic process to provide environmental impact information to federal, state, local, and Indian Nation officials, as well as citizens before decisions are made to take major actions that may significantly affect the environment Federal agencies are required to study, develop, and describe impacts and alternatives and obtain public input to recommended courses of action For DOE and other federal agencies, the NEPA process is an integral part of program planning This process was completed in the Proposed Action Memorandum, RMRS 1998
3 A preconstruction pre-evolution meeting shall be conducted that details all aspects of installation of the ETPTS, the treatment cells, quality assurance, job responsibilities, reporting, etc

2 2 Work Area Preparation

The ETPTS will be oriented generally in an east-west configuration Work area preparation will consist of construction of a 20 to 30 foot wide level work platform

Site security will consist of appropriate posting of the site and visible barrier control It is not anticipated that flagmen or other forms of traffic control will be necessary Trucks and equipment will be entering from Center Avenue and approach the site from the southwest down the dirt road located immediately east of the ETPTS

2 2 1 Site Preparation

Prior to initiating construction operations, the following site preparation activities will be performed by OHM and others

- A Preconstruction Meeting will be held with all project personnel present This will consist of an explanation of OHM/RFETS procedures, points of contact throughout site activities, and a briefing of the HASP
- Coordinating with Safety RFETS personnel (i e , fire department and utilities) to obtain necessary work permits and notices of site construction
- Establishing temporary facilities such as office trailers, storage trailers, sanitary facilities, parking areas, personnel and equipment decontamination areas, areas for storage of construction materials, and areas for staging (containing) construction wastes

- Coordinating and identifying water supply for construction activities and/or personnel and small equipment decontamination
- Coordinating and identifying underground and overhead utilities that may impact construction activities
- Identifying access and haul routes for material deliveries and construction activities
- Establish work zones in accordance with the HASP

2 2 1 1 Sediment and Erosion Control Measures

Several actions to lessen the environmental impact due to erosion will be taken during the construction phase of the ETPTS Project

- Silt fences will be installed downgradient of all intrusive work, as needed
- Trenches or pits shall be backfilled and stabilized as soon as possible to reduce the risk of erosion
- Measures shall be taken, as necessary, to provide sediment and erosion control around temporary soil areas
- Periodic inspections will be made to verify silt fencing is in operational condition
- Hay/straw bales, if required, will be replaced as needed and will be staked

2 2.2 Site Survey

A site survey will be conducted prior to commencement of any construction work at the site Included in the survey will be staking barrier wall alignment at 25-foot intervals along the entire alignment, and surveying of offsets on a 25-foot grid across the area of the site which may be impacted by construction activities Survey tolerances will be maintained to within +/-2 tenths with the exception of well and piezometer surveying, which will be maintained within +/- 1 tenth Survey reference points will also be identified and placed outside of the construction area to be used as reference during construction, and verifying design elevations

2.2 3 Segregation of Topsoil

Prior to trenching or excavating for the ETPTS a minimum of 12 inches of material at the surface will be removed from the areas where construction will be taking place The topsoil will be segregated separately and stockpiled to be used as final cover after construction of the ETPTS The vegetation, including any debris, will be removed prior to stockpiling the topsoil

2 3 Reactor and Discharge Area Construction

The installation of the reactor and discharge system will involve the installation of two treatment cells followed by a metering manhole with final discharge to a french drain The following sections provide detail on the installation of this system

2 3 1 Installation of the Treatment System

The groundwater collected by the barrier wall collection sump will be piped to two treatment cells, followed by a metering manhole with final discharge to a french drain The treatment system will be installed per the approved project Construction Specifications and Drawings

Groundwater movement through the system will be by gravity flow The treatment system will be located northeast of the northern-most part of the barrier wall, south of Pond B-4

The treatment system will be installed below grade, and the excavation will be constructed with the sides of the excavation cut to a 1 5 (horizontal) to 1 (vertical) slope Entrance into the excavation will be limited, but will be required to make plumbing connections between the process equipment Personnel entering the excavation will do so in accordance with OSHA 1910 146, OHM or Rocky Flats permit required confined space procedures, and the Health and Safety Plan for confined space entry Care will be taken to excavate only what is necessary to safely install the ETPTS The bottom of the excavation will be leveled and a reinforced concrete foundation poured, the cells will be placed on top of the foundations It is anticipated that some portion of the treatment cells will be located below the water table Therefore, the cells will be ballasted to prevent flotation if the contents are removed

The treatment cells will be plumbed and valved to allow the operator to change the flow configuration to accommodate the flow in the cells in parallel or series or to be by-passed entirely All piping will be pressure and leak tested to confirm system integrity The valving will be compatible for underground burial and direct loading of the overburden soils

Following installation of the treatment cells and completion of piping connections into and out of the cells, the cells will be filled with media as detailed in the Construction Specifications and Drawings The reactors are approximately 12 feet in diameter and each will be loaded with approximately 58 to 59 tons of reactive iron treatment media The bottom of the reactor will be filled with one foot of permeable filter gravel, covered with geotextile fabric, followed by seven feet of iron and then topped with one foot of a 50/50 iron/pea gravel mixture Finally, a 4-foot railing will be provided around the opening in the tops of each of the treatment reactors

The iron will be delivered in 1 5 ton super sacks with lifting straps and a dispensing chute on the bottom of the sack The iron will be placed into the reactors using a crane to lift the super sacks The sacks will be emptied through the chute in the bottom of the sacks Care will be taken to minimize the dust associated with this activity The person directing the material into the reactor may be required to wear a respirator Dust monitoring will be performed to determine appropriate PPE The iron/pea gravel mixture for the top 1-foot of material in the reactor will be well mixed on site and loaded into the reactors with the bucket of the front-end loader or other appropriate equipment Again, air monitoring will be performed to determine the appropriate PPE

2.3 1 1 Treatment System Materials

The following sections indicate the specifications of the materials required for the construction of the treatment system

Geotextile Filter. The geotextile filter fabric will be a nonwoven or woven pervious sheet of polymeric material with long-chain polymers of at least 85% by weight polyolefins, polyesters, or polyamides The geotextile filter and installation will meet or exceed the requirements of Specification 02272 The physical properties of the fabric will consist of the following

- Apparent opening size between 70-100 (U S Sieve)
- Permittivity of 1 0 Sec^{-1}

- A minimum trapezoid tear, grab tensile, seam strength, and puncture strength of 75, 180, 40, and 110 pounds respectively
- A burst strength of 350 psi
- Ultraviolet degradation of 70% retained at 500 hours

HDPE Treatment Cells The treatment cells will be constructed of Type III, Category 3, Class B high density polyethylene in accordance with ASTM D 1248 The material shell and bottom will be one molded piece with a nominal wall thickness of 1-inch Each cell will be 12 feet in diameter, 12 feet high, and have a 6 feet by 6 feet square double leaf, galvanized or aluminum, hinged top access door for admittance of personnel and installation of treatment media The HDPE treatment cells and installation will meet or exceed the requirements of Specification 02730

HDPE Piping The piping from the collection sump to the treatment cells and finally to the french drain will be constructed of 2-inch HDPE, with a standard dimension ratio (SDR) of 32 5 or less, meeting ASTM D 3350 All fittings associated with the HDPE will be butt fused in the field, threaded or flanged An HDPE or PVC flange will be used to transition from HDPE piping to the cells The HDPE piping and its installation will meet or exceed the requirements of Specification 02660

Valves The ball valves will consist of 2 inch valves with stem extension designed with a working pressure no less than 150 psi The body of the valve will meet the requirements of ASTM D 3550, and the stem will meet the requirements of RFP Standard SP-220 The valves will be designed for below ground installation such that the valves can be operated from the ground surface The valves and their installation will meet or exceed the requirements of Specification 02660

Valve Boxes The valve boxes will consist of cast iron extension type boxes with slide type adjustment and a flared base The cast iron will be at least 3/16 inch thick and the word "water" will be cast into the cover The valve boxes and their installation will meet or exceed the requirements of Specification 02660

Iron Treatment Media The iron will have a grain size distribution of approximately –8 to +50 mesh US Standard Sieve size, and a field bulk density ranging from 140 to 180 pounds per cubic foot The iron treatment media and installation will meet or exceed the requirements of Specification 02730

Granular Material The granular material will consist of well-graded sand or gravel, with no more than 10% by weight passing the No 200 sieve and no less than 95% passing the 1-inch sieve The granular material and its installation will meet or exceed the requirements specified in Specification 02222

Metering Manhole and Flow Measuring Equipment. The metering manhole will be glass-fiber-reinforced polyester and conform to ATSM D 3753 The metering manhole will be up to 4 feet in diameter and height will be determined after the initial survey Antiflotation anchors will be sized and located as required by the manufacturer and the design calculations Themetering manhole and installation will meet or exceed the requirements of Specification 02730

The flow measurement equipment will consist of an HS-Flume, a non-contact ultrasonic flow sensor, and an electronic data storage unit The measurement system will be able to measure

flows of 0 1 to 2 5 gallons per minute A local readout will provide total flow volume in gallons and instantaneous flow rate in gallons per minute Flowlink software (version 3 or later) will provide the means for programming and retrieving stored data from the electronic data storage unit A lead acid battery and a solar battery charger will power the metering system The flow measuring equipment and installation will meet or exceed the requirements of Specification 13321

Railings The railings will consist of ASTM A 53, Schedule 40 pipe sections of 1 25-inch diameter Railings will be shop welded and if field welding is required, ground smooth at all connections and painted yellow All welding material will match filler metal type and meet the requirements of ASTM D1 1 The railings and installation will meet or exceed the requirements of Specification 05720

Bollards The bollards will consist of ASTM A 500, Grade B, Schedule 40 steel pipe sections that have been galvanized in accordance with ASTM A 123 The bollards will be filled with 3,000 psi concrete which meets the requirements of Specification 03300 The bollards and their installation will meet or exceed the requirements of Specification 05720

French Drain The french drain will consist of a 24-inch perforated pipe manufactured of Type III, Category 3, Class B polyethylene in accordance with ASTM D 1248 The perforated pipe will be bedded in ¾-inch to 1½-inch crushed stone The drain will have two influent penetrations, one from the metering manhole and one from the treatment cells The drain will have one effluent penetration for overflow to the South Walnut Creek The overflow drain will be routed to a dispersion gallery constructed to withstand 5 gpm The french drain and its installation will meet or exceed the requirements of Specification 02222

2 3.1 2 Quality Control for Treatment System Construction

The following technical submittals shall be completed prior to commencement of work and/or installation of the associated material and submitted to RMRS for review and approval The submittals required are outlined below

French drain, Section 02222

- Manufacturer's installation instructions for french drain
- Laboratory results for backfill materials

Geotextile, Section 02272

- Manufacturer's and/or fabricator's quality control manuals
- Manufacturer's and/or fabricator's certified quality control test results
- Sample

Piping, Section 02660

- Manufacturer's recommended installation instructions
- Results of pipe testing

Metering manhole, collection sump, and treatment cells, Section 02730

- Manufacturer certified raw material data sheets with quality control certificates
- Manufacturer installation instructions for the metering manhole, including information on antiflotation anchors, collection sump, and the treatment cells
- Manufacturer's and fabricator's certified quality control test results

Concrete, Section 03300

- Concrete mix design, concrete supplier, and batch tickets and history
- Manufacturer's certificates for concrete and grout

Railing and bollards, Section 05720

- Welder's certification

Flow measuring equipment, Section 13321

- Manufacturer's catalog data, shop drawings, installation instructions for flow level measuring equipment components, HJS Flume, and ultrasonic transmitter
- Manufacturer's catalog data, shop drawings, installation instructions for read-out device
- Manufacturer's operating and maintenance instructions for each piece of equipment furnished

Quality control during installation will involve the verification of grade, maintenance of inventory of geosynthetic rolls, verification of handling and storage of geosynthetics, installation in accordance with the manufacturer's installation instruction, conformance to the Design Specifications, and overall system integrity This verification will be conducted utilizing the three phases of inspection Checklists will be generated prior to initiating this phase of work and will be used to verify compliance throughout completion of the treatment system installation The quality control program for installation of the treatment system will also include the following

- Treatment system piping will be both pressure tested and leak tested The pressure test will be a 1-hour hydrostatic test at a pressure of 20 psi The hydrostatic test will be a 2-hour test at 50 psi

    - *Testing Procedure* - This procedure was adapted from PPI Technical Report TR31 by the Plastics Pipe Institute

      - Fill the pipeline with water after it has been laid, bleed off any trapped air Subject the lowest element in the system to a test pressure of 20 psi, and check for any leakage When, in the opinion of the engineer, local conditions require that the trenches be backfilled immediately after the pipe has been laid, apply the pressure test after backfilling has been completed

      - The test procedures consist of two steps the initial expansion and the test phase When test pressure is applied to a water-filled pipe, the pipe expands During the initial expansion of the pipe under test, sufficient make-up water must be added to the system at hourly intervals for three hours to maintain the test pressure After about four hours, initial expansion should be complete and the actual test can start

      - When the test begins, the pipe is full of water and is subjected to a constant test pressure of 20 psi The test phase should be conducted for one hour after which time any water deficiency must be replaced and measured Add and measure the amount of make-up water required to return to the test pressure The allowance for expansion under 20 psi test pressure for 2-inch HDPE piping after one hour is 0 08 gal per 100 feet of piping

- The hydrostatic test consists of maintaining a 50-psi test pressure over a period of two hours, and then dropping the pressure by 10 psi (0 069 Mpa) If the pressure then remains within 5% of the target value for one hour, this indicates there is no leakage in the system

- Prior to setting the treatment cells, the elevations will be verified to assure that the as-built elevations are at the design elevations
- All HDPE welds used to weld the HDPE pipe will be visually inspected for weld integrity
- All piping will initially be backfilled with 1 5 feet of granular material Native material will be used to backfill the trench to grade The trench will be backfilled in 12-inch lifts and will be wheel rolled for compaction

2.4 Collection Trench Area Construction

The collection trench construction will involve the excavation of the trench and installation of the barrier wall, trench backfill, and installation of the collection sump The following sections provide additional details regarding the construction of the collection trench

2 4 1 Trenching and Installation of the Barrier Wall

The trench will be excavated to the desired depth along the length of the barrier wall The 80-millimeter HDPE sheeting will be suspended along the downgradient side of the trench The HDPE sheets will be installed as excavation of the trench is completed to minimize the time the excavation is open Excavation of the trench and construction of the barrier wall collection system will be started at one end of the trench and progress to the terminal end of the barrier system The HDPE sheets are 15 feet wide and 15 to 20 feet long depending on the length required allowing for 3 feet above grade The sheets will be joined with an interlocking sealable joint system The HDPE barrier wall will be constructed continuously from the easternmost end of the alignment to the westernmost end of the alignment

The HDPE sheets will be lifted and placed using light duty cranes (18 to 25 tons) or boom trucks The sheets will be fixed to a support structure to give the sheets rigidity Placed sheets will be held with the crane or boom truck while a second crane or boom truck is used to lift and thread the next sheet in the barrier system The sheets will be supported by piping to the top of the north sidewall of the excavation during the backfill procedures

Once the sheets are in place, the bottom of the trench will be backfilled with bentonite to seal the bottom of the HDPE sheets and limit the potential for underflow of groundwater around the barrier system The bentonite will be placed in one 24-inch lift through the chute in the bags

Once the bentonite is in place, geotextile will be placed across the bentonite and up the upgradient slope to separate the bentonite from the granular backfill The trench will be backfilled with 4 inches of granular backfill, and then the perforated HDPE collection piping will be installed on top of the backfill

The collection piping will be constructed of 4-inch HDPE perforated pipe with solid HDPE sections extending to grade at each end of the trench for clean out stations A geotextile sock will be required to prevent fines from entering the collection piping

The granular backfill will be backfilled to approximately 3 feet above the water table, approximately 8 feet of material throughout the trench The 2-inch conveyance pipe will be placed between the perforated pipe and the top of the granular backfill based on the design elevations The geotextile fabric will then be folded back to separate the granular backfill from the impermeable soil and native soil A minimum of 3 feet of impermeable soil will be placed on top of the granular backfill If more than 3 feet of soil is needed to bring the trench back to level ground, random backfill may be used, once the 3 feet of impermeable soil is placed

Low-permeable soil will be placed in successive horizontal 10- to 12-inch loose lifts and compacted with a minimum of 5 passes of the compaction equipment The random backfill will be placed in successive horizontal layers not to exceed 12-inch loose lifts and compacted with a minimum of 2 passes of compaction equipment The bentonite and granular backfill have no particular lift or compaction limitations

2 4 1 1 Barrier Wall Materials

The following sections indicate the specifications of the materials required for the construction of the barrier wall

Geotextile Filter The geotextile filter fabric will be a nonwoven or woven pervious sheet of polymeric material with long-chain polymers of at least 85% by weight polyolefins, polyesters, or polyamides The geotextile and its installation will meet of exceed the requirements of Specification 02272 The physical properties of the fabric will consist of the following

- Apparent opening size between 70-100 (U S Sieve)
- Permittivity of 1 0 Sec^{-1}
- A minimum trapezoid tear, grab tensile, seam strength, and puncture strength of 75, 180, 40, and 110 pounds respectively
- A burst strength of 350 psi
- Ultraviolet degradation of 70% retained at 500 hours

Geomembrane Vertical Barrier The panels will be constructed of 80-mil HDPE geomembrane The geomembrane and its installation will meet of exceed the requirements of Specification 02271 The HDPE geomembrane will be manufactured of first quality resin, and have the following properties

- Tensile strength at break of 280 lbs/in width
- Elongation at break of 600%
- Tear and puncture resistance of 45 and 100 pounds, respectively
- Low Temperature brittleness of –90°F
- Stress Crack Resistance of 200 minimum hours

The panels will be connected with the interlocking sealable joint system All joints will be visually inspected to ascertain the integrity of the seam

HDPE Collection Piping. The piping for subdrains will be constructed of 4-inch perforated corrugated HDPE drainpipe A geofabric sock will be placed over the collection pipe to prevent fines from entering the pipe Piping for collection pipe will be designed for 5-gpm flow All fittings associated with the subdrains will be connected with manufacturers specified snap

couplings An HDPE or PVC flange will be used to transition from HDPE piping to the cells The HDPE piping and its installation will meet or exceed the requirements of Specification 02490

Granular Material. The granular material will consist of well-graded silica-based sand, gravel, with no more than 10 percent by weight passing a No 200 mesh sieve and no less than 95 percent by weight passing a 1-inch sieve

Low-Permeability Material. Soils excavated from the trench that meet the soil classifications per ASTM D 2488 of SC, CL, GC, ML, MH, or CH

Random Backfill. Excavated material not meeting the requirements or in excess of the quantity required as low-permeability material

Bentonite The bentonite used for the bottom seal will be transported to the site in 1 5 ton super sacks and consist of commercial grade high solids pure bentonite The bentonite will be either granules or pellets and will be no bigger than 0 25 inches in diameter

2 4.1 2 Quality Control for Barrier Wall Installation

The following technical submittals shall be completed prior to commencement of work and/or installation of the associated material and submitted to RMRS for review and approval The submittals required are outlined below

Backfill materials, Section 02222

- Visual classification of the low-permeability materials in accordance with ASTM D 2488
- Certified test reports and analysis for granular material in accordance with ASTM D 422
- Compaction equipment and procedures to be used during compaction to meet the specifications

Bubdrainage system for collection trench, Section 02249

- Manufacturer's installation recommendations for each material or procedure

Geomembrane and geotextile, Sections 02271 and 02272

- Geomembrane manufacturer's certified raw and sheet material data sheets and quality control certificates
- Geomembrane and geotextile manufacturer's and/or fabricator's quality control manuals
- Geomembrane and geotextile manufacturer's and/or fabricator's certified quality control test results
- Geomembrane certified factory seam strength test results
- Geomembrane and geotextile sample
- Manufacturer specifications and drawings will be submitted for the HDPE panels and interlocking system

Quality control during installation will involve the verification of grade, maintenance of inventory of geosynthetic rolls, verification of handling and storage of geosynthetics, installation in accordance with the manufacturer's installation instructions, conformance to the Design Specifications, and overall system integrity This verification will be conducted utilizing the three phases of inspection Checklists will be generated prior to initiating this phase of work and will be used to verify compliance throughout completion of the barrier wall installation The quality control program for installation of the barrier wall will also include the following

- Each HDPE panel will be numbered for positioning in the trench This will be based on the depth of the trench at particular alignment locations The HDPE panels will be inspected upon delivery to site and prior to installation Any foreign material will be removed from the joints and any damage to, or nonconformity of, joints and/or panels will be repaired or rejected
- The integrity of the interlock between the adjacent panel will be verified by noting the joint/sealant connection during installation If there is any question that the sealant is not properly installed, the panel will be pulled and reset
- HDPE welds used to weld the collection pipe to the collection sump will be visually inspected for weld integrity
- Maintenance and submission of final as-built drawings of geomembrane installation showing panel/sheet numbers and penetrations
- Maintenance and submission of inspection checklists, in field-test reports, and daily quality control reports
- A minimum of one particle size analysis in accordance with ASTM D 422 will be performed on each different type of material used as backfill

2.4.2 Collection Sump Installation

The collection sump will provide a collection point for groundwater captured by the barrier and collection system The collection piping will be plumbed into a 48-inch collection sump, located on the up-gradient side of the barrier wall Collected groundwater will be piped from the collection sump to the treatment cells located down the slope from the sump The sump will be constructed of fiber reinforced polyethylene and will be manufactured off-site Drawing 0107 of the design contains a detail showing the collection sump details The collection sump will be engineered so that it will classify structurally as a confined space to allow personnel entry into the sump for service or maintenance

If soil conditions are not stable during the excavation for the sump, an area approximately five feet by seven feet will be shored using an approved shoring system Prior to lowering the collection sump into place, the bottom of the excavation will be prepared with approximately two feet of the same backfill material used in the trench to structurally support the bottom of the sump Entry into the shored excavation will be limited When entry is required, it will be done in accordance with all applicable confined space entry rules and regulations All penetrations through the sump for the collection and effluent piping will be mechanical connections Prior to backfilling, the sump will be filled with water Backfill material will consist of the same backfill material used in the trench

2 4 2.1 Collection Sump Materials

The following sections indicate the specifications of the materials required for the construction of the manholes

Granular Material The granular material will consist of well-graded silica-based sand, gravel, with no more than 10 percent by weight passing a No 200 mesh sieve and no less than 95 percent by weight passing a 1-inch sieve

Collection Sump The sump will be 48 inches in diameter with a nominal wall thickness of 1-inch The outside of the sump will be ribbed with a smooth interior surface All penetrations into

the sump will be sealable with standard fittings and methods with integral frames and covers The sump will have hinged accessway and protected by standard, concrete-filled bollards The collection sump will meet or exceed the requirements of Specification 02730

2 4 2 2 Quality Control for Sump Installation

The following technical submittals will be provided by OHM prior to commencement of work and/or installation of the associated material and submitted to RMRS for review The submittals required are outlined below

- Prior to purchasing the collection sump, manufacturer's raw material data sheets will be generated by the vendor and submitted to OHM for review and submission to RMRS
- Prior to installation of the collection sump, manufacturer's and/or fabricator's certified quality control test reports and installation instructions will be generated by the vendor and submitted to OHM for review and submission to RMRS
- Prior to backfill operations, geotechnical data on the backfill material will be reviewed and submitted

Quality control during installation will involve the verification of grade, installation in accordance with the manufacturer's installation instructions, conformance to the Design Specifications, and overall system integrity This verification will be conducted utilizing the three phases of inspection Checklists will be generated prior to initiating this phase of work and will be used to verify compliance throughout completion of the sump installation

2.5 Well Construction and Abandonment

This task will involve the installation of four groundwater monitoring wells, installation of three trench-monitoring piezometers, and the abandonment of up to 11 geoprobe wells The wells will be installed in compliance with RMRS procedures

2 5.1 Groundwater Monitoring Wells

Four groundwater monitoring wells will be installed The wells will be installed by a driller licensed in the State of Colorado and a geologist with at least 3 years of experience in hazardous waste projects, logging, and well installation A well permit will be prepared for each well and signed by a member of the Rocky Flats Facility environmental staff prior to submittal to the State of Colorado

Each well will be constructed according to Specification 02671 and pertinent RFETS standard operating procedures The wells will be constructed with 2-inch inside diameter (ID) schedule 40 PVC flush-threaded pipe casing and screen, silica sand, filter pack, bentonite seal, cement-bentonite grout, concrete surface pad, protective cover, and metal identification tag The wells will be installed using 6 25-inch ID, 10 25-inch outside diameter (OD) hollow stem augers Continuous soil samples will be collected using a split tube sampler or a continuous sampler

After the borehole has been drilled, the well screen and riser pipe will deconned and carefully placed The well screen will be placed approximately at the weathered bedrock/colluvium interface or at otherwise directed by RMRS project staff Filter pack will be continuously installed in the boring from 0 5 feet below the screen with a steam cleaned tremie pipe or through the hollow stem auger Frequent measurements will be made inside the annulus during

retraction of the augers to ensure the filter pack is properly placed The depth of the top of the filter pack will be directly measured and recorded

The bentonite seal will be placed on top of the filter pack to a minimum thickness of 1 foot and a maximum thickness of 1 5 feet, before hydration The bentonite will be placed in 6-inch lifts and hydrated with water When the full thickness of the seal has been placed, a minimum of 2 hours will be allowed for complete hydration of the seal before grouting Grout will only be required if it is needed to meet the minimum requirements after placement of 1 5 feet of bentonite seal and 3 0 feet of concrete surface seal If grout is required, no work will be conducted in the well within 48 hours of grouting and the alignment will be verified prior to placing the cement surface seal

The concrete surface seal will be placed to a minimum depth of 1 5 feet and a maximum depth of 3 0 feet below ground surface The steel protective casing will be placed over the riser during the concrete surface seal placement The concrete surface seal will be allowed to settle prior to pouring the surface pad The surface pad will be 3 feet square and a minimum of 5 inches thick

Water removed during drilling will be filtered of its fines and placed in 55-gallon drum or other designated container, properly labeled and placed on pallets The fines and drill cuttings will be placed in 55-gallon drum, properly labeled and placed on pallets The drum placement and disposition will be coordinated with RMRS Section 5 0 gives additional details regarding waste management activities

2.5 1.1 Groundwater Monitoring Well Materials

The following sections indicate the specifications of the materials required for the construction of the groundwater monitoring wells Due to the shallow depths of the wells, centralizers should not be required, however, if centralizers are required, they will be constructed of stainless steel

Well Casing The well casing will consist of new, 2-inch Schedule 40 flush-joint thread ASTM D 1785 PVC pipe The fitting will meet the requirement of ASTM F 480 and be flush thread male by female fittings The well casing and its installation will meet or exceed the requirements in Specification 02671

Well screen The well screen will consist of commercially fabricated flush-joint threaded 2-inch Schedule 40 PVC with continuous slots in a non-clogging design The screen slot size will be 0 010 inch and a screen length of 5 feet The fitting will meet the requirement of ASTM F 480 and be flush thread male by female fittings The well screen and its installation will meet or exceed the requirements in Specification 02671

Filter Pack The filter pack will consist of clean, washed, rounded to sub-rounded siliceous material free from calcareous grain and organic matter The filter pack gradation will be 16-40 with no more than 5 percent by weight smaller than 0 010 inches and a uniformity coefficient no exceeding 2 5 The filter pack and its installation will meet or exceed the requirements in Specification 02671

Bentonite Seal The bentonite seal will consist of hydrated, 0 25-inch sodium montmorillonite pellets furnished in sacks or buckets from a commercial source and free of impurities The bentonite seal and its installation will meet or exceed the requirements in Specification 02671

Cement-Bentonite Grout The grout will consist of a maximum of 7 gallons of approved water per bag of Portland Cement and 3 to 5 percent by weight of bentonite powder The Portland

Cement will conform to ASTM C 150 The cement-bentonite grout and its installation will meet or exceed the requirements in Specification 02671

Concrete Surface Seal and Pad The cement seal will adhere to ASTM C 150, Type I, air-entrained with aggregate meeting ASTM C 33, resulting in nonshrinking concrete The concrete and its installation will meet or exceed the requirements in Specification 03300

Protective Cover The protective cover will be 6-inch square and 5 feet in length and constructed of steel with a hinged, locking cap A corrosion resistant metal tag will be fixed to the casing with the well identification number, elevation of the highest point on the rim of the well casing, elevation of the ground surface at the well, well coordinate, date of the well installation and top of the protective casing elevation in feet The protective cover and its installation will meet or exceed the requirements in Specification 02671

2 5 1 2 Quality Control for Groundwater Monitoring Well Installation

The following technical submittals will be provided by OHM prior to commencement of work and/or installation of the associated material and submitted to RMRS for review The submittals required are outlined below

- Survey coordinates, elevations, and notes
- Documentation and quality control reports
- Permits and/or licenses necessary for the execution of work

Quality control during installation will involve the verification of grade, installation in accordance with the manufacturer's installation instructions, conformance to the Design Specifications, and overall system integrity This verification will be conducted utilizing the three phases of inspection Checklists will be generated prior to initiating this phase of work and will be used to verify compliance throughout completion of the well installation

Borehole logs will be prepared for each well by the geologist and will contain the following minimum information name of the project and site, boring/well identification number, location of boring, coordinate, driller, drilling equipment used, date, reference data for all depth measurements, total depth of boring, drilling method and description, stratum changes, stratus description, structural observations, drill fluid status, depth to water, and sample number(s) The geologist and driller will sign the borehole logs

Installation diagrams will be prepared for each well by the geologist and contain the as-built condition of the well The diagram will include the following minimum information project name and site, well identification, driller, installation date, well material description, well depth, hole diameter, depth to screen and filter pack, depths to seals, elevations/depths/heights of key features of the well, well coordinates, static water level, comments, and surface completion description

Once the well installation is complete, the as-built installation drawing for each monitoring well prepared by the geologist present during the installation will be submitted In addition, the well location maps with survey coordinates and elevations will be submitted to RMRS

2.5.2 Water-level Monitoring Piezometers

Three trench water-level monitoring piezometers will be installed in the collection trench during backfilling operations Approximate depths to the bottom of the piezometers are seven to fifteen

feet below grade Well materials will consist of one-inch ID Schedule 40 PVC flush-threaded casing, with a two-foot length of factory slotted (0 010 inch) casing with bottom cap The completions will include a bentonite seal of 0 25-inch pellets, cement-bentonite or high-solids bentonite grout, concrete surface pad, protective cover (stick-up design), and a metal identification tag

The piezometers will be installed through a 4-inch temporary PVC casing as the trench is being backfilled The bottom of the piezometer screen will be placed six inches from the top of the impermeable seal on the bottom of the trench Filter pack will be installed in the temporary casing from 0 5 feet below the screen to 1 foot above the predicted high water level in the trench as backfill operations continue Sufficient care will be taken during backfill operation that the piezometer remains vertical The depth of the top of the filter pack will be directly measured and recorded

The bentonite seal will be placed from 1 5 feet below the bottom of the impermeable cap and extend 6 inches into the impermeable cap of the trench The bentonite will be placed in 6-inch lifts and hydrated with water When the full thickness of the seal has been placed, a minimum of 2 hours will be allowed for complete hydration of the seal before grouting Grout will be placed in one continuous pour into the annulus above the bentonite seal to the surface If grout is required, no work will be conducted in the piezometer within 48 hours of grouting

The steel protective casing will be placed over the riser during the concrete surface seal placement The concrete surface seal will be allowed to settle prior to pouring the surface pad The surface pad will be 1 feet in diameter and extend 4 inches above the ground surface and 8 inches below the ground surface

2 5 2 1 Water-level Monitoring Piezometer Materials

The following sections indicate the specifications of the materials required for the construction of the water-level monitoring piezometers Due to the shallow depths of the wells, centralizers should not be required, however, if centralizers are required, they will be constructed of stainless steel

Piezometer Casing. The piezometer casing will consist of new, 1-inch Schedule 40 flush-joint thread ASTM D 1785 PVC pipe The fitting will meet the requirement of ASTM F 480 and be flush thread male by female fittings The piezometer casing and its installation will meet or exceed the requirements in Specification 02672

Piezometer screen The piezometer screen will consist of commercially fabricated flush-joint threaded 1-inch Schedule 40 PVC with continuous slots in a non-clogging design The screen slot size will be 0 010 inch and a screen length of 2 feet The fitting will meet the requirement of

ASTM F 480 and be flush thread male by female fittings The piezometer screen and its installation will meet or exceed the requirements in Specification 02672

Bentonite Seal The bentonite seal will consist of hydrated, 0 25-inch sodium montmorillonite pellets furnished in sacks or buckets from a commercial source and free of impurities The bentonite seal and its installation will meet or exceed the requirements in Specification 02672

Cement-Bentonite Grout The grout will consist of a maximum of 7 gallons of potable water per bag of Portland Cement and 3 to 5 percent by weight of bentonite powder The Portland

Cement will conform to ASTM C 150 The cement-bentonite grout and its installation will meet or exceed the requirements in Specification 02671

Protective Cover The protective cover will be 4-inch round and 5 feet in length and constructed of steel with a hinged, locking cap A corrosion resistant metal tag will be fixed to the casing with the piezometer identification number, elevation of the highest point on the rim of the piezometer casing, elevation of the ground surface at the piezometer nest, piezometer coordinates, date of the piezometer installation and top of the protective casing elevation in feet The protective cover and its installation will meet or exceed the requirements in Specification 02671

2 5 2 2 Quality Control for Water-level Monitoring Piezometer Installation

The following technical submittals will be provided by OHM prior to commencement of work and/or installation of the associated material and submitted to RMRS for review The submittals required are outlined below

- Catalog Data for trench monitoring piezometer screens, casing, riser pipe, filter pack material, bentonite, cement, surface protective covers, and locking cap
- Documentation and quality control reports
- Permits and/or licenses necessary for the execution of work

Quality control during installation will involve the verification of grade, installation in accordance with the manufacturer's installation instructions, conformance to the Design Specifications, and overall system integrity This verification will be conducted utilizing the three phases of inspection Checklists will be generated prior to initiating this phase of work and will be used to verify compliance throughout completion of the piezometer installation

The piezometers will be tested to determine the piezometer's ability to respond to water fluctuations and ensure that the piezometer's integrity after installation is intact The piezometers will be filled with water and measuring the drawdown in the piezometer at specified time increments with a water-level measuring device The static water level will be measured at the following time increments during the test 5, 10, 20, 30, 45, 60, 120, 180 seconds and 4, 5, 6, 10 minutes

Installation diagrams will be prepared for each piezometer by the Design Engineer and contain the as-built condition of the piezometer The diagram will include the following minimum information project name and site, piezometer identification, name of individual preparing the diagram, installation date, piezometer material description, piezometer depth, hole diameter for bentonite and grout seal, depth to screen and filter pack, depths to seals, elevations/depths/heights of key features of the piezometer, piezometer coordinates, static water level, comments, and surface completion description

Once the piezometer installation is complete, the as-built installation drawing for each piezometer prepared during the installation will be submitted In addition, the piezometer location maps with survey coordinates and elevations will be submitted to RMRS

In the event that a piezometer needs to abandoned due to improper installation, it will be abandoned in accordance with the requirements of the State of Colorado and the Specifications Records will be maintained as piezometer abandonment activities are conducted These

records will contain the following minimum information project name, piezometer number, piezometer location, depth and diameter, date of abandonment, method of abandonment, material utilized in abandonment, casing or items left in the hole, description and quantity of grout used, description and quantities of grout used daily to compensate for settlement, water or mud level prior to grouting and date measured, and reason for abandonment

2 5.3 Abandonment

Up to 11-temporary geoprobe wells may have to be abandoned The geoprobe wells were installed in 1997 to characterize the soil and groundwater for placement of the barrier wall collection system The wells are constructed of 1-inch PVC casings The PVC casings will be pulled which is set approximately 1 5 feet below ground surface, and the well casings will be filled with 0 25-inch bentonite pellets hydrated in two-foot lifts as described in the Rocky Flats well abandonment SOP Some of these wells are located in the trench alignment and will potentially be excavated These wells will not be abandoned The PVC removed during the excavation will be segregated from the material removed

Records will be maintained as well abandonment activities are conducted These records will contain the following minimum information project name, well number, well location, depth and diameter, date of abandonment, method of abandonment, material utilized in abandonment, casing or items left in the hole, description and quantity of grout used, description and quantities of grout used daily to compensate for settlement, water or mud level prior to grouting and date measured, and reason for abandonment

2.6 Work Area Restoration

Work area restoration will involve final grading, topsoil replacement, and seeding and will performed in accordance with Specification 02935 Prior to initiating seeding, certificates of compliance certifying that materials meet the requirements in Specification 02935 and certified reports including the percent of live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested, and state certification will be submitted to RMRS

Topsoil previously stockpiled during grubbing and excavation activities will be uniformly replaced to an approximate depth of 6 inches The topsoil, once replaced, will be back dragged to smooth out the area and prepare for revegetation Topsoil finished surface will be reasonably smooth, compacted, and free from irregular surface changes to the degree obtainable from blade operations Following topsoil placement and preparation, the topsoil will be tilled to a minimum depth of 6 inches

The seed mixture will be a State approved seed of the latest season's crop with less than 1-percent weed seed The seed will be inspected upon arrival to the job site for conformance with the specifications and stored in a cool dry location until placement The standard seed mixture shall consist, and be applied at a rate of, the following

Big Bluestem	8 lbs/acre
Little Bluestem	8 lbs/acre
Western Wheatgrass	12 lbs/acre
Sideoats Gamma	8 lbs/acre
Blue Grama	8 lbs/acre

Blue Flax	4 lbs/acre
Buffalo Grass	8 lbs/acre

The seeding and fertilizer shall be applied by broadcast seeding and crimping methods It is not anticipated that disturbed areas will occur on slopes that will require erosion control measures (i e , blanket, etc) Half of the seed will be broadcast in one direction, and the remainder of the seed at right angles to the first direction After seeding, the area will be covered with ¼ to ¾ inch of soil by disk barrow, steel mat drag, culipacker or other approved method Finally, the area will be rolled with a roller that does not exceed 90 pounds per each foot of roller width Straw or hay mulch will be spread at a rate of 2 tons per acre and mechanically anchored with a V-type wheel landpacker The straw and/or hay will be free from weeds and in air-dry condition and suitable for placing with blower equipment

2 7 Demobilization

Upon completion of construction activities, heavy equipment will be demobilized from the project site, trailers, storage units prepared for transportation, and supplies removed from the site Construction equipment will be cleaned by pressure washing, broom cleaning, or a combination of approved cleaning methods The goal of this work is to prevent tracking debris or soil out of the ETP Site Rental equipment will be returned in good condition

3.0 PROJECT SUPPORT ACTIVITIES

Details of project support activities are presented in the following sections

3 1 Quality Assurance/Quality Control

Incorporated within this document is a construction quality control (CQC) plan for the installation Specific inspection tasks, which are the responsibility of the installation contractor (OHM) or its subcontractors have been presented in previous sections The ETPTS construction will be conducted in accordance with the OHM *Quality Assurance Program Plan* Due to the scope of activities associated with this task, all 10 of the criteria apply to the scope of work The Design Engineer, Mr Kent Friesen, will also act as the Construction Quality Control (CQC) Supervisor As such, Mr Friesen will complete the three phases of inspection for each definable feature of work, inspect items as they are delivered to the site, inspect installation prior to backfilling, and document daily QC activities through the Daily QC Report

A major purpose of the CQC process is to provide documentation for those individuals who were unable to observe the entire construction process (e g , representatives of the permitting

agency) so that those individuals can make informed judgments about the quality of construction for a project Specific documentation requirements of the installation contractor (OHM) and its subcontractors are presented in the following sections All such documents will be submitted to RMRS

3 1 1 Inspection and Testing Reports

All observations, results of field tests, and results of laboratory tests performed on site or off site shall be recorded on a suitable data sheet Recorded observations may take the form of notes, charts, sketches, photographs, or any combination of these Where possible, a checklist may

be useful to ensure that pertinent factors are not overlooked As a minimum, the inspection data sheets shall include the following information

- Description or title of the inspection activity,
- Location of the inspection activity or location from which the sample was obtained,
- Type of inspection activity and procedure used (reference to standard method when appropriate or specific method described in FIP),
- Unique identifying impermeable barrier membrane sheet number for cross-referencing and document control,
- Recorded observation or test data,
- Results of the inspection activity (e g , pass/fail), comparison with specification requirements,
- Personnel involved in the inspection besides the individual preparing the data sheet

The Preparatory, Initial and Follow-up Inspection checklists will be completed prior to initiating a definable feature of work The definable features of work for the ETPTS are

- Excavation, Backfill and Grading of Collection Trench
- Excavation, Trenching, and Backfilling for Treatment System and French Drain
- Subdrainage System for Collection Trenches
- Geomembrane Vertical Barrier
- Separation/Filtration Geotextile
- Treatment System Piping
- Groundwater Monitoring Wells and Geoprobe Abandonment
- Water-Level Monitoring Piezometers
- Metering Manholes, Collection Sump, and Treatment Cells
- Turf
- Concrete
- Railings and Bollards
- Flow Measuring Equipment

3 1 2 Problem Identification and Corrective Measures Reports

A problem is defined as any material or workmanship that does not meet the requirements of the plans, specifications or FIP for the project or any obvious defect in material or workmanship, even if there is conformance with plans, specifications and the FIP As a minimum, problem identification and corrective measure reports shall contain the following information

- Location of the problem,
- Description of the problem (in sufficient detail and with supporting sketches or photographic information where appropriate) to adequately describe the problem,
- Unique identifying serial or identification numbers (if applicable) for cross-referencing and document control,
- Root cause,
- How and when the problem was located (reference to inspection data sheet or daily summary report by inspector),
- Where relevant, estimation of how long the problem has existed,
- Any disagreement noted by the inspector between the inspector and contractor about whether or not a problem exists or the cause of the problem,

- Suggested corrective measure(s),
- Documentation of correction if corrective action was taken and completed prior to finalization of the problem and corrective measures report (reference to inspection data sheet, where applicable),
- Suggested methods to prevent similar problems, if appropriate

3 1.3 Drawings of Record

Drawings of record (also called "as-built" drawings) shall be prepared to document the actual lines, grades, and conditions of each component of the ETPTS The record drawings shall include logistic data for a particular component, the plan dimensions of the component, and locations of any test samples acquired during installation of the ETPTS For impermeable barrier membrane components, the record drawings shall show the dimensions of all membrane field panels, the location of each panel, identification of all seams and panels with appropriate identification numbering or lettering, location of all patches and repairs, and location of all destructive test samples Separate drawings may be needed to show record cross sections and special features such as monitoring portal locations Electronic and hard copies of the as-builts will be submitted to the CTR and RFETS Engineering Document Control

3 2 Meetings

Communication is extremely important to quality management Quality construction is easiest to achieve when all parties involved understand clearly their responsibility and authority Meetings can be very helpful to make sure that responsibility and authority of each organization is clearly understood During construction, meetings can help to resolve problems or misunderstandings and to find solutions to unanticipated problems that have developed

3 2 1 Preconstruction Meeting/Pre-evolution Meeting

The preconstruction meeting will be held immediately before construction is started, including representatives of RMRS, OHM, subcontractors, and key material suppliers The purpose of this meeting is to review the details of the HASP and FIP, to make sure that the hazards are known and that responsibility and authority of each individual is clearly understood, to agree on procedures to resolve construction problems, and to establish a foundation of cooperation in quality management

It is very important that the procedures for inspection and testing be known to all, that the criteria for pass/fail decisions be clearly defined (including the resolution of test data outliers), that all

parties understand the key problems that the CQA personnel will be particularly careful to identify, that each individual's responsibilities and authority be understood, and that procedures regarding resolution of problems be understood

3.2.2 Progress Meetings

Weekly progress meetings shall be held Weekly meetings can be helpful in maintaining lines of communication, resolving problems, identifying action items, and improving overall quality management When numerous critical work elements are being performed, the frequency of these meetings can be increased to biweekly, or even daily Persons who should attend this meeting are those involved in the specific issue(s) being discussed At all times the RMRS

representative, OHM Superintendent, Project Manager, or designated representative, should be present

Daily plan of the day meetings shall be conducted to discuss work to be performed for that workday Health and safety issues shall be discussed daily and problem resolution will be determined and discussed as required

3 3 Sample Custody

Soil and groundwater sampling is not required for this project If a sample is requested and taken, a chain of custody record shall be made for that sample If the sample is transferred to another individual or laboratory, records shall be kept of the transfer so that chain of custody can be traced The purpose of keeping a record of sample custody is to assist in tracing the cause of anomalous test results or other testing problems, and to help prevent accidental loss of test samples

3.4 Weather

Weather can play a critical role in the installation of the ETPTS Installation is particularly sensitive to weather conditions, including temperature, wind, humidity, and precipitation The installation subcontractor (OHM) is responsible for complying with the contract plans and specifications (along with the CQC plans for the various components of the system) It is the responsibility of the contractor or installer to make sure that these weather restrictions are observed during construction

3 5 Work Stoppages

Unexpected work stoppages can occur due to a variety of causes, including labor strikes, contractual disputes, weather, QC/QA problems, etc When stoppages occur, the installation contractor (OHM) and its subcontractors will attempt to ensure that (1) in-place materials are covered and protected from damage, (2) partially covered materials are protected from damage, and (3) manufactured materials are properly stored and properly or adequately protected The cessation of construction should not mean the cessation of inspection and documentation

3 6 Permitting

It is anticipated that installation of the ETPTS at this site can be done under existing agreements between the site owners and the State of Colorado regulatory agencies, and that no additional permits will be required Permits to construct monitoring wells will be submitted to the State Engineers Office

3 7 Construction Health and Safety Plan

This task includes a safety and health review, which will be conducted concurrently with the preliminary design review A HASP has been written for the ETPTS construction activities and will be approved before activities can be started at the site

3.8 Post-Construction Submittals

Once construction and demobilization is complete, post-construction activities will be initiated Post-construction activities include preparation of closeout submittals Within 30 days of project completion, the following records will be transmitted to RMRS

- As-built drawings (electronic and hard copies)
- Chain-of-custody forms
- Field and Laboratory calibration records
- Survey reports
- Forms completed from Standard Operating Procedures
- Training and qualification records
- Permit compliance reports
- Concurrence reports
- Maps
- Photographs
- Electronic media
- Quality Assurance records
- Logbook/Field Notes maintained by the designated Health and Safety Representative
- Copies of all daily pre-work briefings
- Final copy of OSHA 200 Log
- All health and safety-related documentation including monitoring results and employee notification forms

4.0 WASTE MANAGEMENT

Soils considered to be potentially affected will be stockpiled on the area where the topsoil had been removed and within the trench area

Soils meeting the type considered for trench cap will be segregated As required, all soil will be field screened using a photoionization detector (HNU), as soils are excavated Any soils containing detectable concentrations of VOCs shall be handled as potentially contaminated and properly evaluated for handling All excess soil generated will be graded over the trenched area and revegetated It is assumed that there will be no soil generated, which will require disposal

Soil generated as a result of installing the monitoring wells will either be raked out on site or drummed as required by RMRS SOP's

During construction of the barrier wall, it is not expected to be necessary to pump groundwater from the saturated zone soils out of the excavation Based on groundwater information collected to date, it is assumed that there will not be an appreciable quantity of water accumulation in the excavation during the time that it is estimated to excavate and backfill the trench If the water that accumulates in the trench does need to be removed due to the inability to construct the collection trench as designed, then water will be pumped into a temporary holding tank and transported to the RMRS consolidate for disposal

PPE generated during the construction activity will be placed in bags, appropriate paperwork completed, and staged for disposal by RMRS

4 1 Spill Prevention and Control

The ETPTS Project, company, contractor, and subcontractor personnel are required to call the RMRS CTR or designee, or in their absence, the Plant Shift Superintendent's Office (PSS) at 966-2914 or by radio and report any spill or any incident with potential adverse environmental, health, or safety effects The employee discovering/causing the incident has the responsibility to report it to the PSS and his/her supervisor immediately This responsibility must be communicated to all employees working on the ETPTS Project Any spill hazardous to life or the environment should be immediately reported to extension 2911 or 2911 on the radio

The Site Spill Prevention Program requires that all possible precautions be taken to minimize the likelihood of a spill Guidelines for design and construction of hazardous material storage tanks (e g , fuel tanks, chemical tanks, etc) and secondary containment are specified in *Design Standards for Hazardous/Toxic Waste and Material Storage Tanks, Dikes and Transfer Stations, (4)* Y/TS-104 At this time, it is not anticipated that this project will involve materials that would require Y/TS-104 standards

Any fuel storage tank(s) of greater than 100-gallon capacity are required to be diked to minimize the probability of any release to the watershed All containers over five gallons are required to be labeled with the appropriate Hazardous Identification Label (diamond) as identified in the National Fire Protection Association Code (NFPA-704) (5)

All heavy equipment and mechanical equipment will be maintained in good repair so as to minimize the release of engine, transmission, or other oils through slow leaks Idle equipment will be parked as far away from streambeds as practical At the request of the company representative, a drip pan provided by the contractor will be used under contractor equipment that is leaking excessively

Fueling operations will be performed with care, and allowances will be made for fuel expansion to prevent inadvertent small releases Fuel tanks will be contained within temporary dikes and inspected regularly Fuel, lubricant, or coolant spilled by contractors, if any, will be cleaned up daily, placed in appropriate containers, and disposed of in accordance with RMRS operations procedures, communicated by the Project Manager

There is a plant-wide contingency plan in the event that an emergency evacuation of the plant is required It is the employer's responsibility to provide emergency signal and procedure information to his/her employees

If a spill occurs at the ETPTS Project, all safe, practical methods available will be used to prevent material from entering streams, ponds, or springs (Spill response kits containing sorbent material will be provided by the company representative during construction Sorbent pillows, temporary earth dikes, or other means will be readily available on-site and be used as appropriate without risking personnel safety

4.2 Good Housekeeping Practices

All personnel present at the ETPTS Project site will observe good housekeeping practices at all times Paper trash and refuse will be collected, contained and disposed at the site on a daily basis No unpermitted wastewater of any type will be discharged on-site All rinse water containing additives of any sort (e g , soap, degreasers, cleaning agents etc) will be collected,

contained, and disposed in accordance with the appropriate plant waste disposal procedures Trucks hauling material on- and off-site will not be overfilled Loose debris will be contained within the vehicles to prevent littering of highways and haul roads Brush, construction debris, and trash will be removed from drainage ways and streams

Fueling operations will be conducted so that small (de minimis) fuel/oil releases are contained and cleaned up daily Appropriate precautions are to be taken to minimize discharge of fuel, coolants, oil, lubricants, grease, and other hydrocarbons

5.0 PROJECT SUBMITTALS

Submittal requirements are outlined in the Design Specifications

5.1 Administration and Site Indirect

The management of the site will be the responsibility of the OHM Superintendent under the direction of the Project Manager The Superintendent will continuously monitor the project's costs and schedule, and inform RMRS and OHM's Program Office of any variances in cost or schedule

5.1.1 Operation and Maintenance Manual

An Operation and Maintenance Manual (O&M Manual) will be prepared The O&M manual will provide a method- and site-specific manual describing all aspects of system operation The system is designed requiring a minimal amount of O&M

5 2 Health and Safety Plan

A HASP has been written for the ETP and will be approved before activities can be started at the site The HASP or amendments to the HASP will include a hazard analysis for each portion of the process train to ensure that associated activities of excavation and backfilling operations are performed safely The hazard analysis will focus on potential hazards to operators, people outside of the operation, and impact to the local environment The results from this analysis will determine what level of hazard assessment will be necessary, at this time, it is expected that a low-level hazard assessment will result The HASP will also identify the applicable state and federal compliance requirements specific to the project

6.0 REFERENCES

Parsons, 1998 *East Trenches Plume Project Drawings*, November

Parsons, 1998 *East Trenches Plume Project Specifications*, November

RMRS, 1998, *Draft Proposed Action Memorandum for the East Trenches Plume*, RF/RMRS-98-258 UN, September

Figure 1
East Trench Plume Organization Chart